

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

Elementary 3-5

Materials/Preparation

- ☐ Teacher Material A – Mineral Comparison – one per teacher
- ☐ Teacher Material B – Soil Organisms – one per teacher
- ☐ Handout A – Composting Concepts: Moisture – one per student
- ☐ Assessment A – Composting – one per student
- ☐ Writing instruments
- ☐ Clear glass or plastic jar with lid
- ☐ Student access to the Internet, reference books, or other sources.
- ☐ Materials for lab: leaves (2 per student), magnifying glass, zippered sandwich bags (2 per student), and spray bottle of water
- ☐ *Where the Sidewalk Ends* by Shel Silverstein
- ☐ A video reading of the poem “Sara Sylvia Cynthia Stout” can be found at http://www.teachertube.com/viewVideo.php?video_id=92707
- ☐ *Garbage Helps Our Garden Grow: A Compost Story* by Linda Glaser

Fun Fact

Corn always has an even number of rows on each ear.

Composting for Better Soil

Minnesota K-12 Academic Standards

Science	3.4.1.1 5.4.1.1	Living things are diverse with many different characteristics that enable them to grow, reproduce and survive.
Science	5.4.2.1	Natural systems have many components that interact to maintain the system.
Language Arts	3.6.3.3 4.6.3.3 5.6.3.3	Write narratives and other creative texts to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

Summary/Overview

In this lesson, students learn about composting: its definition, its effect on soil, how to make it, and what lives in it.

Garden Connection

Gardens provide us with the nutrients we need. Compost provides garden soil the nutrients it needs to support plants.

Background Information

Composting is a method of recycling as old as time. The Earth composts as a matter of course.

Compost releases its nutrients slowly, over several months or years. As students complete the activities, they begin to understand more about the relationship of healthy soil to healthy plants. For instance, the nutrients humans get from vegetables are because plants need many of the same minerals, and get them from the soil.

Composting is also a way to reduce the amount of trash going to the landfill. It is amazing to think of the amount of food waste that goes into trash bags; it is free fertilizer when used properly. Soil retains fertilizers better when enriched with compost. Less fertilizer runs off to pollute waterways.

Students are taught how to compost food scraps and garden waste, producing a product they can use to enhance garden and potting soil. Compost balances both acid and alkaline soils, bringing pH levels into a good range of nutrients. Compost is also natural topdressing for lawns.

Tiny organisms, especially microorganisms, do much of the work of composting. Time and weather are factors, but good microorganism activity speeds up the process. Students will learn about these organisms.

Compost helps bind clusters of soil particles (aggregates). Soil rich in aggregates is full of tiny channels and pores that hold air, moisture, and nutrients like a sponge. Compost helps sandy soil hold water and nutrients that would normally wash right out. Compost particles attract and hold nutrients strongly enough to prevent them from washing out,

but loosely enough so that plant roots can take them up as needed. Compost also breaks up tightly bound particles in clay or silt soil, allowing roots to spread, water to drain, and air to penetrate. It changes the texture and structure of all soils, increasing their resistance to erosion and making them easier to work with and cultivate ("A Green Guide to Yard Care," Texas Natural Resource Conservation Commission).

The key to composting is adding a balance of materials. An easy way to do that is to include "greens," or food and yard wastes such as fruit skins, rotting vegetables, and grass clippings. This adds active nitrogen. To avoid animal pests and odors, do not add meats, bones, dairy products, or fats. For best results, add an equal portion of "browns" to provide carbon. Browns are similar kitchen and yard wastes that have dried out such as dead flower stalks, dried leaves, and shredded paper. Adding paper from your shredder is an excellent way to balance the amount of kitchen scraps you use.



Keep the compost moist and always add some garden soil when you begin. Soil contains the organisms you need to help the composting process.

Some classrooms may be able to start a composting project at their schools, especially if they are including an outdoor garden in the year's activities. Some people have concerns that composting will attract pests and produce odors. Too many decomposing fruits and vegetables can cause odor. But when the compost has a good balance of wet to dry, and is turned so that it is not compacted (greens to browns), odors do not occur or are minimal. For that reason, it is best to locate a compost pile close enough to your building or home to be usable, but far enough away to not cause concerns about odors and pests.

Many classrooms that cannot use an outdoor compost pile will try indoor composting, called vermiposting. Many Cooperative Extension programs and nurseries offer composting classes or directions.

Objectives

- Define composting.
- Describe what happens in a compost pile.
- List the components of a compost pile.
- Name an organism that lives in compost.

Procedure

Interest Approach

Read the poem, "Sara Sylvia Cynthia Stout" from Shel Silverstein's *Where the Sidewalk Ends*. This humorous poem is about a little girl who lived with her father and would do anything except throw the garbage out. As a result, it piled as high as the sky. Your class will love it, and it can be a springboard for discussion on what else she might have done with the garbage. In the poem, there is a long litany of items Sara piled high. Have students make a list of the garbage mentioned in the poem.

Summary of Content and Teaching Strategies

Begin a class discussion on compost. Questions to use as discussion starters might include:

- What do you know about composting?
- What is going on in the compost pile or bin?
- What are microorganisms?
- What does healthy soil have to do with you?
- Why is compost good for plants?
- How can you make compost?
- What lives in a compost pile?

Read the book *Garbage Helps Our Garden Grow: A Compost Story*.

A quick, optional decomposition lesson can be found on Handout A.

Compost is a rich, soil-like mixture that is produced when organic matter breaks down. When compost is added to soil, it adds nutrients that plants need and improves soil texture.

Ask students if they see anything similar about the two words compost and decompose. Discuss fruit that has been in the kitchen too long and how it starts to get soft and black. It is decomposing. This means it is changing and breaking down.

Composting is a way to recycle and make usable product from things we might throw out, like apple cores, eggshells, dried leaves, and wilted lettuce. We can create a compost bin or pile in our yards. Add “greens” like kitchen scraps, “browns” like yard wastes, some water and some garden soil. This is the recipe for a compost pile! Do not add meat scraps or fats like butter or cheese. Ask students to look at their list of garbage from the Shel Silverstein poem. Discuss which items would be appropriate for composting and which should be thrown away.

Show Teacher Material B. Microorganisms are tiny creatures that live in the soil and feed on organic matter. Organic matter is made up of things that were once alive, or part of something alive. It will decompose (break down) over time. Microorganisms help the process of decomposition. They eat what we wouldn’t! They help change a banana peel into a rich, brown product called humus. Sometimes they are so active they create heat. A warm or “hot” compost pile is breaking down rapidly.

Compost is good for plants because it improves soil. Plants need nutrients just like we do. If foods grow in healthy soil, they are more likely to give us the nutrients we need. Ask students how they would probably feel if the foods they ate had very few nutrients in them because they grew in poor soil. Show Teacher Material A and review minerals needed by people and plants.

Compost is made by layering greens and browns. Moisture and microorganisms are needed to assist in decomposing the greens and browns.

- **greens** - kitchen and yard waste (like grass clippings)
- **browns** - dried leaves, garden wastes, and shredded paper
- **moisture** - do not let the compost dry out, but don’t over-water it, either
- **microorganisms** - add some garden soil; the living microorganisms in the soil feed on the compost materials, multiply, and break down your wastes.

Compost piles should be turned or stirred. Active compost heats up as microorganisms go to work. The more it heats, the sooner it will be ready to use.

Many organisms live in compost to help the ingredients decompose.

Sources/Credits

Adapted from New York Agriculture in the Classroom and Cornell University’s *Sciences of Life Explorations* (SOLE). The full lesson plan can be viewed at <http://www.agclassroom.org/ny/resources/pdf/activities/composting.pdf>

Examples of organisms found in compost include earthworms, snow bugs, millipedes, pill bugs, springtails, soil mites, beetles, ants, centipedes, land snails, soil bacteria, nematodes, and soil funguses. Assign students or groups of students an organism to research. They create a poster that answers the following questions:

1. What is the name of your organism?
2. What does it eat?
3. Can you see it without magnification?
4. Is it an insect? If not, what is it? (Remember, insects have six jointed legs.)

Share the posters with the class.

Review/Summary

As a class, review the questions below:

- What do you know about composting?
- What is going on in the compost pile or bin?
- What are microorganisms?
- What does healthy soil have to do with us?
- Why is compost good for plants?
- How can we make compost?
- What lives in a compost pile?

Modifications/Extensions

Build a compost bin on the school grounds. Have students and parents assist with the construction. Once the bin is ready to be filled, students collect greens and browns from around the school and help with the layering process. More information on composting is available from the University of Minnesota Extension website at <http://www.extension.umn.edu/distribution/horticulture/DG3296.html>.

Mineral comparison

Look at the list of minerals that people need to be healthy.

Look at the list of minerals that plants need to be healthy.

Circle the mineral nutrients that are needed by both people and plants.

People need:

Boron
Calcium
Chromium
Copper
Fluoride
Iodine
Iron
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Selenium
Vanadium
Zinc

Plants need:

Boron
Calcium
Chloride
Copper
Iron
Magnesium
Manganese
Molybdenum
Nitrogen
Phosphorus
Potassium
Sulfur
Zinc

Soil organisms

These organisms can typically be found in one cup of undisturbed native soil.

Bacteria	200 billion
Protozoa	20 million
Fungi	100,000 meters
Nematodes	100,000
Arthropods	50,000

Source: Colorado State University Extension

Insert pictures of above named organisms

Name _____



Composting Concepts: Moisture

Moisture content is one of the key ingredients for composting. This activity helps you discover its importance.

Leaf experiment

Materials

- ☐ leaves
- ☐ magnifying glass
- ☐ zippered sandwich bags
- ☐ spray bottle of water

1. Bring two green leaves to school.
2. Observe leaves with a magnifying glass. Draw a picture of each leaf in the chart below.
3. Put each leaf into a plastic bag and label with your name.
4. Seal one bag (label it CLOSED) and leave the other one open (label it OPEN).
5. Twice a week, spray water lightly on the leaf in the CLOSED bag. Leave the OPEN bag dry.
6. Predict what changes you expect to see and record them in the space below.
7. Observe your leaves, making note of changes so you can compare them with your initial prediction.

Prediction

observations

Day	closed Bag	open Bag

conclusion

Write a summary of the experiment and your findings.

Name _____



Composting

1. Composting is *(check one)*

- ☐ a way to recycle.
- ☐ a way to make soil healthier.
- ☐ a process using microorganisms to help break down organic matter.
- ☐ all of the above.

2. Kayley is creating an outdoor compost bin and she is ready to fill it. She has vegetable scraps, grass clippings, weeds from the flower garden, and some soil. She has a full water bucket ready to pour. What is she missing? *(circle one)*

meat scraps

leaves, pine needles, and shredded paper

moldy cheese

diseased plants

3. Name two organisms that live in compost piles.

4. Plants and people need many of the same mineral nutrients.

- ☐ True ☐ False

5. Name two things you should not put into a compost pile or bin.

6. Organic is something that is living or once living. Name something that is inorganic.

7. Is paper an organic material?

☐

Yes

☐

No

Why?
